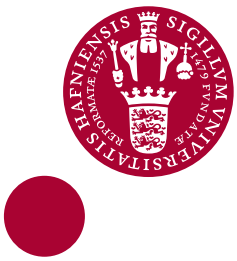

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# IFRO Commissioned Work

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# Introduction

The ICES Advice (version 2) on fishing opportunities, catch, and effort covering cod (*Gadus morhua*) in subdivisions 22–24, western Baltic stock (western Baltic Sea) published 3rd June 2016[1] provided an advice that total commercial catches and thus the TAC in 2017 for the western Baltic cod stock should be no more than 917 tonnes. Including eastern Baltic cod fished in subdivision 24 in the TAC for subdivisions 22-24 according to the ICES advice, the total TAC for subdivisions 22-24 could be 1,588 tonnes. Based on this TAC, the Danish quota will be 686 tonnes in 2017, which is a major reduction compared to previous years, where it was 7,639 tonnes in 2015[2] and 6,248 tonnes in 2016[3].

Based on the above, the Danish Agrifish Agency has requested an analysis of the financial consequences of such a quota reduction for Danish fishermen fishing on the cod quota in the western Baltic Sea, subarea 22-24.

Besides the direct financial impact on the fishermen, the possible implications for the onshore services and processing industry is also investigated.

Finally, considerations of any alternative possibilities for the fishermen to adapt their fishery to this situation is also requested.

The Department of Food and Resource Economics, University of Copenhagen has addressed these questions through the research-based consultancy contract that the Department has with the Ministry of Environment and Food.

# 1. Description of the Danish fishery in the western Baltic Sea

Based on data from the Danish Agrifish Agency, a description of the Danish fishery in the western Baltic Sea is given below. The description will be based on data from the latest available year, 2015.

In 2015, 392 Danish fishing vessels have recorded landings of cod from the western Baltic Sea[4], cf. Table 1. 154 of these vessels were commercial vessels having a total yearly landings value above 270,000 DKK (36,000 €) from their entire fishery, while the remaining vessels were less active-commercial having a landings value below 270,000 DKK, but above 0. These less active-commercial fishermen are primarily part time fishermen, who have registered landing values so low that they most likely must also have another income in order to sustain a reasonable living standard. Furthermore, 311 of the vessels were below 12 metres in vessels length.

[1] ICES Advice (2016) on fishing opportunities, catch, and effort, Baltic Sea Ecoregion, Cod (*Gadus morhua*) in subdivisions 22–24, western Baltic stock (western Baltic Sea), version 2, 3 June 2016.
[2] Covers the Danish quota including quota swaps made during 2015.
[3] Covers the Danish quota including quota swaps made until 7th July 2016.
[4] The total number of vessels in the Danish fishery was 2,634, of which 960 was considered as inactive having no registered landings at all in 2015

## Table 1 Number of vessels with landings of cod from the western Baltic Sea, 2015

| Length | Primary gear | Commercial vessels | Less active-commercial vessels | Total |
|---|---|---|---|---|
| **<12m** | Gillnet/hook | 39 | 128 | 167 |
| | Dory/trap | 11 | 65 | 76 |
| | Seine/gillnet/trawl | 18 | 41 | 59 |
| | Trawl | 8 | 1 | 9 |
| **<12m Total** | | **76** | **235** | **311** |
| **12-15m** | Gillnet/hook | 2 | | 2 |
| | Seine/gillnet/trawl | 7 | 2 | 9 |
| | Trawl | 17 | 1 | 18 |
| **12-15m Total** | | **26** | **3** | **29** |
| **15-18m** | Gillnet/hook | 1 | | 1 |
| | Seine/gillnet/trawl | 8 | | 8 |
| | Seine | 3 | | 3 |
| | Trawl | 21 | | 21 |
| **15-18m Total** | | **33** | | **33** |
| **18-24m** | Seine | 7 | | 7 |
| | Trawl | 9 | | 9 |
| **18-24m Total** | | **16** | | **16** |
| **24-40m** | Trawl mixed | 1 | | 1 |
| | Trawl consumption | 2 | | 2 |
| **24-40m Total** | | **3** | | **3** |
| **Total** | | **154** | **238** | **392** |

Source: The Danish AgriFish Agency Vessel Register and Sales Notes Register 5th April 2016.

Note: A commercial vessel has a yearly landings value above 270,000 DKK, while a less active-commercial vessel has a yearly landings value below 270,000 DKK.

The less active-commercial vessels are to a varying degree highly dependent on fishing in the western Baltic Sea. As shown in Table 2, 267 vessels, or two thirds of all vessels obtained between 90 and 100% of their landings value from fishing in the western Baltic Sea in 2015, and the majority of these vessels were below 12 metres in overall length.

## Table 2 Vessel economic dependency on fishery in the western Baltic Sea, 2015

| | Commercial vessels | | | | | | Less active -commercial vessels | | | Total |
|---|---|---|---|---|---|---|---|---|---|---|
| Interval | <12m | 12-15m | 15-18m | 18-24m | 24-40m | Total | <12m | 12-15m | Total | |
| 90-100% | 44 | 7 | 3 | | | 54 | 211 | 2 | 213 | 267 |
| 80-89% | 2 | 2 | | | | 4 | 3 | | 3 | 7 |
| 70-79% | 2 | 2 | 2 | | | 6 | 3 | | 3 | 9 |
| 60-69% | 5 | 3 | 3 | | | 11 | 4 | | 4 | 15 |
| 50-59% | 2 | 2 | 4 | | | 8 | | | | 8 |
| 40-49% | 2 | 2 | 1 | 1 | | 6 | 5 | | 5 | 11 |
| 30-39% | 7 | 3 | 2 | | | 12 | 1 | | 1 | 13 |
| 20-29% | 1 | | 3 | 5 | 2 | 11 | 3 | | 3 | 14 |
| 10-19% | 2 | 2 | 8 | 8 | | 20 | 1 | 1 | 2 | 22 |
| 0-9% | 9 | 3 | 7 | 2 | 1 | 22 | 4 | | 4 | 26 |
| **Total** | **76** | **26** | **33** | **16** | **3** | **154** | **235** | **3** | **238** | **392** |

Source: The Danish AgriFish Agency Vessel Register and Sales Notes Register 5th April 2016.

The commercial vessels that land the majority of the cod caught in the western Baltic Sea, cf. Table 3, and the average landings of cod generally increases with the length of the vessel, cf. Table 4.

## Table 3 Total landings of cod in the western Baltic Sea per fleet segment

| | | Total live weight (tonnes) | | | Total landings value (1,000 DKK) | | |
|---|---|---|---|---|---|---|---|
| Length | Primary gear | Commer-cial | Less active-commercial | Total | Commer-cial | Less active-commercial | Total |
| **<12m** | Gillnet/hook | 890 | 397 | 1,288 | 13,916 | 4,760 | 18,675 |
| | Dory/trap | 64 | 54 | 118 | 914 | 716 | 1,630 |
| | Seine/gillnet/trawl | 277 | 100 | 377 | 4,113 | 1,228 | 5,341 |
| | Trawl | 186 | 1 | 188 | 2,516 | 18 | 2,534 |
| **12-15m** | Gillnet/hook | 103 | | 103 | 1,804 | | 1,804 |
| | Seine/gillnet/trawl | 166 | 5 | 171 | 1,920 | 28 | 1,949 |
| | Trawl | 1,051 | 5 | 1,056 | 11,211 | 41 | 11,252 |
| **15-18m** | Gillnet/hook | 121 | | 121 | 2,304 | | 2,304 |
| | Seine/gillnet/trawl | 428 | | 428 | 5,360 | | 5,360 |
| | Seine | 84 | | 84 | 796 | | 796 |
| | Trawl | 1,104 | | 1,104 | 10,828 | | 10,828 |
| **18-24m** | Seine | 465 | | 465 | 5,656 | | 5,656 |
| | Trawl | 805 | | 805 | 7,939 | | 7,939 |
| **24-40m** | Trawl mixed | 427 | | 427 | 3,738 | | 3,738 |
| | Trawl consumption | 445 | | 445 | 4,725 | | 4,725 |
| **Total** | | 6,616 | 562 | 7,180 | 77,740 | 6,791 | 84,531 |

Source: The Danish AgriFish Agency Vessel Register and Sales Notes Register 5th April 2016.

## Table 4 Landings of cod per vessel, 2015

| Length | Primary gear | Avg. live weight (tonnes) Commer-cial | Less active-commercial | Total | Avg. landings value (1,000 DKK) Commer-cial | Less active-commercial | Total |
|---|---|---|---|---|---|---|---|
| **<12m** | Gillnet/hook | 3 | 1 | 1 | 40 | 7 | 17 |
| | Dory/trap | 1 | 0 | 0 | 12 | 3 | 5 |
| | Seine/gillnet/trawl | 3 | 0 | 1 | 38 | 5 | 16 |
| | Trawl | 4 | 1 | 4 | 52 | 9 | 51 |
| **12-15m** | Gillnet/hook | 5 | | 5 | 95 | | 95 |
| | Seine/gillnet/trawl | 6 | 1 | 5 | 66 | 5 | 56 |
| | Trawl | 10 | 5 | 10 | 106 | 41 | 105 |
| **15-18m** | Gillnet/hook | 12 | | 12 | 230 | | 230 |
| | Seine/gillnet/trawl | 10 | | 10 | 122 | | 122 |
| | Seine | 8 | | 8 | 80 | | 80 |
| | Trawl | 11 | | 11 | 112 | | 112 |
| **18-24m** | Seine | 9 | | 9 | 111 | | 111 |
| | Trawl | 38 | | 38 | 378 | | 378 |
| **24-40m** | Trawl mixed | 107 | | 107 | 935 | | 935 |
| | Trawl consumption | 89 | | 89 | 945 | | 945 |

Source: The Danish AgriFish Agency Vessel Register and Sales Notes Register 5th April 2016.

Table 5 shows the species composition of landings value for the vessels catching cod in the western Baltic Sea. For most of the fleets, the landings value obtained from catching cod is a major contributor to the total landings value derived from their fishing activity in the western Baltic Sea. Besides being caught in a directly targeted fishery, cod in the western Baltic Sea is also caught as bycatch in most of the other consumption fisheries that is taking place there. Primarily landings of sprat (reduction species) and herring are caught in directly targeted fisheries.

## Table 5 Distribution of landings value on species in the western Baltic Sea, 2015

| | Length | Primary gear | Cod | Other round fish | Flatfish | Reduction species | Other species | Total landings value (1,000 DKK) |
|---|---|---|---|---|---|---|---|---|
| Commercial | **<12m** | Gillnet/hook | 59% | 0% | 25% | 0% | 16% | 23,649 |
| | | Dory/trap | 12% | 0% | 5% | 0% | 83% | 7,509 |
| | | Seine/gillnet/trawl | 69% | 0% | 28% | 0% | 3% | 5,979 |
| | | Trawl | 63% | 0% | 35% | 0% | 1% | 4,000 |
| | **12-15m** | Gillnet/hook | 69% | 1% | 24% | 0% | 6% | 2,608 |
| | | Seine/gillnet/trawl | 62% | 0% | 26% | 10% | 2% | 3,088 |
| | | Trawl | 73% | 1% | 12% | 12% | 3% | 15,461 |
| | **15-18m** | Gillnet/hook | 77% | 0% | 21% | 0% | 2% | 2,989 |
| | | Seine/gillnet/trawl | 74% | 1% | 15% | 9% | 1% | 7,223 |
| | | Seine | 84% | 0% | 2% | 0% | 14% | 950 |
| | | Trawl | 65% | 1% | 21% | 11% | 2% | 16,723 |
| | **18-24m** | Seine | 98% | 0% | 2% | 0% | 0% | 5,766 |
| | | Trawl | 83% | 6% | 6% | 5% | 0% | 9,516 |
| | **24-40m** | Trawl mixed | 83% | 17% | 1% | 0% | 0% | 4,517 |
| | | Trawl consumption | 89% | 10% | 1% | 0% | 0% | 5,308 |
| Less active-commercial | **<12m** | Gillnet/hook | 49% | 0% | 27% | 0% | 23% | 9,622 |
| | | Dory/trap | 14% | 0% | 10% | 0% | 76% | 5,296 |
| | | Seine/gillnet/trawl | 39% | 0% | 51% | 0% | 10% | 3,140 |
| | | Trawl | 20% | 0% | 79% | 0% | 0% | 88 |
| | **12-15m** | Seine/gillnet/trawl | 53% | 1% | 17% | 16% | 13% | 53 |
| | | Trawl | 85% | 1% | 12% | 0% | 3% | 48 |

Source: The Danish AgriFish Agency Vessel Register and Sales Notes Register 5th April 2016.

The geographical location of the vessels catching cod in the western Baltic Sea is shown in Table 6, where the vessels are registered according to home county. Most of the vessels are as could be expected located around the western Baltic Sea, i.e. Fyn, Storstrømmen and Bornholm, and will therefore also contribute to the local economy by the use of the local harbours and their facilities.

## Table 6 Distribution of vessels between counties, 2015

| Counties | Commercial vessels | | | | | Less active-commercial | | Total |
|---|---|---|---|---|---|---|---|---|
| | <12m | 12-15m | 15-18m | 18-24m | 24-40m | <12m | 12-15m | |
| Fyn | 13 | 10 | 11 | 1 | | 67 | | 102 |
| Storstrømmen | 13 | 6 | 4 | | | 44 | | 67 |
| Bornholm | 10 | 6 | 6 | 4 | 2 | 20 | 1 | 49 |
| Frederiksborg | 10 | 1 | 8 | | | 17 | 1 | 37 |
| Vestsjælland | 6 | | 1 | | | 27 | | 34 |
| København | 7 | | | | | 19 | | 26 |
| Sønderjylland | 4 | | 1 | | | 13 | 1 | 19 |
| Ringkøbing | 6 | 1 | 1 | 9 | | 1 | | 18 |
| Roskilde | 4 | | | | | 8 | | 12 |
| Vejle | | | | | | 11 | | 11 |
| Aarhus | 2 | 1 | 1 | | | 3 | | 7 |
| Nordjylland | 1 | 1 | | | | 4 | | 6 |
| Viborg | | | | 2 | 1 | 1 | | 4 |
| **Total** | **76** | **26** | **33** | **16** | **3** | **235** | **3** | **392** |

Source: The Danish AgriFish Agency Vessel Register and Sales Notes Register 5th April 2016.

Table 7 shows, where the landings are made. For instance, 11% of the cod caught in the western Baltic Sea are landed in Bagenkop, where also 9% of all landings is made.

## Table 7 Harbour distribution of landings value in the western Baltic Sea for the ten most important harbours, 2015

| Harbour | Cod |
|---|---|
| Bagenkop | 11% |
| Ystad | 8% |
| Klintholm havn | 8% |
| Køge | 7% |
| Langø | 6% |
| Rønne | 5% |
| Spodsbjerg | 5% |
| Gilleleje | 4% |
| Kerteminde | 4% |
| Gedser | 4% |

| Harbour | All landings |
|---|---|
| Bagenkop | 9% |
| Langø | 6% |
| Ystad | 6% |
| Klintholm havn | 6% |
| Køge | 6% |
| Rødvig | 6% |
| Kerteminde | 5% |
| Spodsbjerg | 4% |
| Rønne | 4% |
| Gilleleje | 3% |

Source: The Danish AgriFish Agency Vessel Register and Sales Notes Register 5th April 2016.

Most of the harbours included in Table 7 are very dependent on the landings value derived from the fishery in the western Baltic Sea, cf. Table 8.

**Table 8 Harbour dependency on landings value from fishing areas, 2015**

| Harbour | Western Baltic Sea | Kattegat | North Sea | Skagerrak | Eastern Baltic Sea | Total landings value (1,000 DKK) |
|---|---|---|---|---|---|---|
| Bagenkop | 98% | 1% | 0% | 0% | 1% | 12,583 |
| Klintholm | 94% | 0% | 0% | 0% | 6% | 11,506 |
| Køge | 100% | 0% | 0% | 0% | 0% | 7,653 |
| Gedser | 100% | 0% | 0% | 0% | 0% | 3,211 |
| Gilleleje | 24% | 76% | 0% | 0% | 0% | 29,979 |
| Kerteminde | 100% | 0% | 0% | 0% | 0% | 7,443 |
| Langø | 100% | 0% | 0% | 0% | 0% | 8,349 |
| Rønne | 92% | 0% | 0% | 0% | 8% | 9,782 |
| Rødvig | 99% | 0% | 0% | 0% | 1% | 5,944 |
| Spodsbjerg | 100% | 0% | 0% | 0% | 0% | 5,782 |

Source: The Danish AgriFish Agency Vessel Register and Sales Notes Register 5th April 2016.

Note: Ystad is not included, because it is a Swedish harbour

## 2. Financial consequences for the fishermen

In order to assess the financial repercussions of the reduced cod quota in the western Baltic Sea, a calculation is carried out with landings data from 2015 and estimated cost data for 2015 (based on 2012-2014 cost data). The calculation is static-comparative, and addresses the question, what could have happened in 2015, if the cod quota had been 686 tonnes and not 7,639 tonnes. The data sources are the Vessel Register and Sales Notes Register hosted by the Danish AgriFish Agency and the Cost and Earnings Database hosted by Statistics Denmark. Calculations of the long term effects following any changes in stock and fleet size are not considered.

Cost information is only available for the commercial vessels, thus the financial performance indicators are only calculated for the commercial vessels, while landings weight and value are calculated for all the vessels that in 2015 caught cod in the western Baltic Sea.

Having 2015 as the baseline, the financial consequences will be addressed based on two scenarios indicating the expected minimum and maximum repercussions on the profitability of the vessels. Depending on the fishermen's possibilities to change their behaviour, this could to some extent reduce the effects. However, depending on the type of changed behaviour, this could result in reduced fishery options for other fishermen, who are not fishing in the Baltic Sea. It is doubtful whether this could happen without interference in the current management of the fishery with individual transferable quotas, see also Section 4.

In the minimum repercussion scenario, it is assumed that the reduced cod quota in the western Baltic Sea will only result in reduced landings of cod, but assuming that the cod quota is utilised 100% in 2015 instead of 94%, which was the actual quota utilisation in 2015. In this scenario, it is assumed that catches of cod can be avoided, which will require change in fishing patterns. There are some differences in fishing seasons for the various species, with the season for cod peaking in winter and spring, but by-catches of cod cannot be completely avoided in the seasons for other

fish than cod. It is therefore assumed that part of the cod quota is reserved for by-catches in other fisheries and seasons. Otherwise a conflict with the landing obligation may arise in this scenario.

In the maximum repercussions scenario, it is assumed that not only the landings of cod are reduced, but the landings of other consumption species are reduced as well, except species caught with no or little bycatch of cod, i.e. herring, sprat, sand eel, salmon and eel. The applied reduction is calculated as the proportion between a landing of 686 tonnes cod (assuming 100% utilisation) and the actual landings of cod in 2015.

From Table 9, it is seen that in the baseline (i.e. 2015) the total landings value was 344 mill DKK from all areas 22-24 by the 392 vessels catching cod in the western Baltic Sea. If it is assumed that the lower cod quota only has an impact on the catches of cod, the total landings value will be reduced by 77 mill DKK equal to 22%. The reduction will increase to 105 mill DKK, 31%, if the landings of other species are reduced as well. The impact on the small vessels is significant with a reduction in landings value up to 50%, The large vessels fishing in other areas as well is less impacted with reductions at 15-20%.

## Table 9 Total landings value for the vessels catching cod in the western Baltic Sea (1,000 DKK)

| | Length | Primary gear | Baseline | Only lower cod landings | Reduced landings of cod and other species |
|---|---|---|---|---|---|
| Commercial | <12m | Gillnet/hook | 27,669 | 15,083 | 8,609 |
| | | Dory/trap | 7,646 | 6,819 | 5,579 |
| | | Seine/gillnet/trawl | 12,188 | 8,467 | 6,788 |
| | | Trawl | 8,595 | 6,319 | 4,978 |
| | | Total | 56,098 | 36,688 | 25,954 |
| | 12-15m | Gillnet/hook | 2,630 | 998 | 273 |
| | | Seine/gillnet/trawl | 8,458 | 6,721 | 5,945 |
| | | Trawl | 30,854 | 20,715 | 18,958 |
| | | Total | 41,941 | 28,434 | 25,175 |
| | 15-18m | Gillnet/hook | 4,289 | 2,205 | 1,585 |
| | | Seine/gillnet/trawl | 18,965 | 14,117 | 13,020 |
| | | Seine | 4,695 | 3,975 | 3,953 |
| | | Trawl | 62,946 | 53,153 | 49,868 |
| | | Total | 90,895 | 73,449 | 68,426 |
| | 18-24m | Seine | 26,070 | 20,955 | 20,855 |
| | | Trawl | 61,770 | 54,590 | 53,562 |
| | | Total | 87,840 | 75,544 | 74,418 |
| | 24-40m | Trawl mixed | 20,250 | 16,869 | 16,165 |
| | | Trawl consumption | 27,118 | 22,844 | 22,317 |
| | | Total | 47,368 | 39,714 | 38,482 |
| | Total | | 324,142 | 253,829 | 232,455 |
| Less active-commercial | <12m | Gillnet/hook | 10,280 | 5,974 | 2,638 |
| | | Dory/trap | 5,410 | 4,762 | 3,378 |
| | | Seine/gillnet/trawl | 3,821 | 2,710 | 1,004 |
| | | Trawl | 88 | 72 | 8 |
| | | Total | 19,598 | 13,518 | 7,027 |
| | 12-15m | Seine/gillnet/trawl | 237 | 212 | 203 |
| | | Trawl | 48 | 11 | 5 |
| | | Total | 285 | 223 | 208 |
| | Total | | 19,884 | 13,741 | 7,235 |
| Total | | | 344,026 | 267,570 | 239,690 |

Source: Own calculations based on data the Danish Agrifish Agency and Statistics Denmark

In order to calculate the financial repercussions for the vessels involved, this can only be done for the commercial vessels[5]. Following the reduction in landings will entail a reduction in days at sea and, consequently, have an impact on some of the operating costs undertaken, i.e. lower activity gives rise to lower cost. These costs are fuel costs, provision and ice costs, sales costs and crew payments. The remaining costs, i.e. insurance costs, maintenance costs, various other costs and capital costs are considered to be independent of the activity level.

Two financial performance indicators are calculated in form of 1) gross profit: earnings defined as landings value minus operating costs, and thus portrays the surplus available for payment of crew and capital, and 2) net profit: defined as earnings minus crew payments, and thus portrays what is left to pay off the invested capital. The gross profit is regarded the best indicator of the financial development of small vessels of less than 12 metres and some of the vessels 12-15 meters. This is because hired crew is small for these vessels, and hence the proportion of crew payments can be overestimated.

The gross and net profit per vessel in the two scenarios are presented in Table 10 and Table 11. Both indicators show that the financial performance of these vessels will deteriorate significantly, even if only the cod landings are reduced.

## Table 10 Gross profit per vessel (1,000DKK)

| Length | Primary gear | Baseline | Only lower cod landings | Reduced landings of cod and other species |
|---|---|---|---|---|
| <12m | Gillnet/hook | 326 | 76 | -53 |
| | Dory/trap | 362 | 297 | 200 |
| | Seine/gillnet/trawl | 285 | 130 | 61 |
| 12-15m | Gillnet/hook | 793 | 125 | -172 |
| | Seine/gillnet/trawl | 529 | 354 | 276 |
| | Trawl | 915 | 456 | 376 |
| 15-18m | Gillnet/hook | 2,550 | 852 | 348 |
| | Seine/gillnet/trawl | 1,180 | 736 | 635 |
| | Seine | 817 | 636 | 631 |
| | Trawl | 1,697 | 1,325 | 1,200 |
| 18-24m | Seine | 2,206 | 1,642 | 1,631 |
| | Trawl | 4,258 | 3,623 | 3,532 |
| 24-40m | Trawl mixed | 12,508 | 9,853 | 9,285 |
| | Trawl consumption | 8,690 | 7,032 | 6,827 |

Source: Own calculations based on data the Danish Agrifish Agency and Statistics Denmark

[5] Except for trawlers below 12 meters for which there are not sufficient statistical material to undertake the analysis.

## Table 11 Net profit per vessel (1,000 DKK)

| Length | Primary gear | Baseline | Only lower cod landings | Reduced landings of cod and other species |
|---|---|---|---|---|
| <12m | Gillnet/hook | -66 | -138 | -175 |
| | Dory/trap | -191 | -193 | -201 |
| | Seine/gillnet/trawl | -26 | -85 | -112 |
| 12-15m | Gillnet/hook | 215 | -95 | -232 |
| | Seine/gillnet/trawl | 98 | 11 | -28 |
| | Trawl | 194 | -29 | -68 |
| 15-18m | Gillnet/hook | 708 | -92 | -331 |
| | Seine/gillnet/trawl | 314 | 91 | 41 |
| | Seine | 278 | 182 | 179 |
| | Trawl | 610 | 409 | 341 |
| 18-24m | Seine | 741 | 467 | 462 |
| | Trawl | 1,959 | 1,596 | 1,543 |
| 24-40m | Trawl mixed | 7,055 | 5,118 | 4,747 |
| | Trawl consumption | 4,944 | 3,872 | 3,740 |

Source: Own calculations based on data the Danish Agrifish Agency and Statistics Denmark

The reduction is observed within all the fleet segments, but is especially significant for the small vessels below 15 metres. It is not likely that these vessels can continue to fish in the future with the proposed cod quota. If the time perspective of a positive development in the cod stock abundance and quota is years ahead, the small vessels do not have the financial robustness to cope with the rather substantial negative financial repercussions in the years until this happens. Thus they will expectedly leave the fishery and sell their fishing rights to other vessels that are not necessarily located in the same area.

Cod is a key species in this fishery, and many of the other species cannot be caught without also catching cod. Thus, many of these vessels are expected to stop fishing, unless they can change their catching behaviour or find alternatives that can generate an income. Such possibilities are considered more in detail in Section 4.

Furthermore, there are the 238 less active-commercial vessels, for which it is not possible to calculate any financial performance indicators. As shown in Table 9, their total landings value will be reduced to one-third in the worst-case scenario. Despite that these vessels do not fish for a commercial purpose, it is likely that such a reduction will make it too unattractive to be a less active-commercial fisherman, and many of them will have to stop fishing.

## 3. Consequences for the onshore services and processing industry

The consequences outlined above are expected also to have consequences for the onshore services (upstream services) and processing industry (downstream services). From the available data and modelling tools it is, however, too uncertain to calculate the impact on employment and profit for the processing industry and fishery related service industry.

It is of interest to see which counties will be most influenced by the changed conditions. This can be seen in Table 12. As expected, the largest impact on landings value is expected to take place in the counties around the western Baltic Sea, i.e. Fyn, Storstrømmen and Bornholm. These are areas, where the possibilities for alternative employment are, generally considered, limited.

**Table 12 Change in landings value at the county level (1,000 DKK)**

| Counties | Change from baseline to lower cod landings | Change from baseline to reduced landings of cod and other species |
|---|---|---|
| Fyn | -21,705 | -33,548 |
| Storstrømmen | -14,270 | -19,586 |
| Bornholm | -11,462 | -12,880 |
| Ringkøbing | -10,061 | -10,748 |
| Frederiksborg | -5,533 | -7,547 |
| Viborg | -5,531 | -6,489 |
| Vestsjælland | -2,857 | -4,831 |
| København | -1,879 | -3,150 |
| Sønderjylland | -1,317 | -2,375 |
| Roskilde | -859 | -1,354 |
| Nordjylland | -447 | -603 |
| Aarhus | -423 | -747 |
| Vejle | -112 | -478 |

Source: Own calculations based on data the Danish Agrifish Agency and Statistics Denmark

In the small harbours situated in the counties around the western Baltic Sea, there is only minor processing taking place. Some of the landed fish might be sold to local fish mongers and small processing firms. However, mostly it is sold to larger processing firms located in other areas of Denmark or abroad. So there might be some local consequences for the processing industry, but the size of these is impossible to calculate.

Then there is the onshore service industry in form of ship yards, fuel and ice suppliers etc. The lower activity will have an effect for these industries, because the lower activity gives rise to less use of these services for maintenance and repair. Again the magnitude is difficult to estimate with the current knowledge. However, it must also be remembered that these industries are not necessarily solely dependent on the activity within the fishery as also leisure boats are visiting these harbours and thereby generate income for the onshore service.

However, one of the reasons for these tourists visiting these harbours is that there are activity and fishing vessels. If the number of fishing vessels are reduced as expected, the harbours might not be as attractive as before, which could thus have a further negative impact on the onshore services and maybe even more important on the other activities that tourists give rise to in the local economy.

## 4. Possibilities for adapting the fishery

The reduction in the cod quota for the western Baltic Sea will necessarily have negative economic consequences and lead to a reduction in the fleet fishing in this area. The impact is reinforced as the ability and availability of finding ways to alleviate this is very small.

An option to start fishing in other areas and thus other quotas might be a possibility for the larger vessels, but is not considered to be the case for the smaller vessels located in the harbours around the western Baltic Sea. However, what is even more limiting is that these vessels would have to buy quota from the vessels that are currently fishing in the area they would like to switch to. The Danish management system is based on fishing rights covering the most important quotas. Changing fishing activity towards quotas not currently owned, will imply that there is a supply at reasonable prices, which is not considered an option.

Cod is as mentioned often caught in the fishery conducted in the western Baltic Sea and it is almost unavoidable to catch cod. Cod will thus often be a choke species that restricts the utilisation of the other quotas in the western Baltic Sea.

Based on the above, it must be concluded that it will be difficult for these vessels to change their behaviour in a way which can counteract the negative financial repercussions of the reduced cod quota. For some, there might be a few possibilities, but a large reduction in the number of fishing vessels must be expected quite rapidly during 2017.

## Conclusion

Almost the entire quota for cod in area 22-24 is distributed in terms of ITQs, and the vessels holding quota for cod in area 22-24 will bear the entire burden of the reduced cod quota. The burden, however, is reinforced as at least 75% of the vessels are so small that is will be difficult for them to shift to other areas or go further to sea in case it is possible for them to purchase quotas in other areas.

Thus the financial repercussions are considered to be extensive for the fishermen having the majority of their fishing activities in the western Baltic Sea, and unless the stock situation improves considerably very fast, a large number of especially the smaller vessels below 15 meters are expected to leave the fishery during 2017. However, these vessels still carry a substantial amount of fixed costs which will result in a significant capital loss if they have to leave the fishery due to the quota reductions.